

Ill-defined Causes of Death in the Republic of Kiribati, 2005 to 2014

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Abstract

This was a retrospective descriptive study of deaths in the Republic of Kiribati from 2005 to 2014. We determined the proportion of all deaths that are ill-defined and described the characteristics of these ill-defined deaths.

There were 5618 deaths between 2005 to 2014; of these 1049 (18.7%) were ill-defined. Of these, 576 (54.9%) were male. Those aged 65 years and above had the highest proportion of ill-defined deaths at 40% (n= 415), followed by children aged 0-15 years (29.6%, n=310). Further, 47.7% (n=500) of ill-defined deaths were reported by staff from health dispensaries.

When the ill-defined deaths were further categorised according to their R code (with the R code being a group of ill-defined deaths, with sub-groups), 30.5% (n=320) had unknown cause of death, while 29.3% (n=307) had general symptoms and signs.

Almost one fifth of deaths in Kiribati were ill-defined, indicating that the reporting on cause of death can be improved through Medical Certification on Causes of Death training and by other means. Improved cause of death reporting will allow the Ministry of Health and Medical Services to better allocate resources, plan health care service delivery and support the development of evidence based preventative and curative policies.

Abbreviations

ICD – International Classification of Diseases

KCRO – Kiribati Civil Registration Office

MCCD- Medical Certification of Causes of Death

MHMS- Ministry of Health and Medical Services

MS – Monthly Statistics

SORT-IT – Structured Operational Research Training Initiative

SPC- Secretariat of the Pacific Community

TDR- The Special Programme for Research and Training on Tropical Diseases

WHO – The World Health Organization

Introduction

The Republic of Kiribati is a Micronesian Pacific island nation located in the central Pacific Ocean. It is comprised of 33 atolls scattered over a vast area of 3.5 million square kilometres and has a population of 110,110 people.¹ Approximately half of the population live on the capital island of Tarawa, a narrow atoll of only 17 square kilometres. Kiribati is classified as a lower middle income country² and the main resources are copra and fishing licences.³

Kiribati faces numerous challenges with regards to the health of its population including a large burden of non-communicable diseases,⁴ a persistent burden of infectious diseases, and the impending health effects of climate change.⁵ A number of health statistics trail behind other nations including life expectancy at 70 years for males and 80 years for females, and the under-five mortality rate which is 59 per 1000 live births.⁶ The crude birth and death rates are 28.7 births per 1000 population and 4.6 deaths per 1000 people, respectively.⁶ In neighbouring Pa-

cific Island countries such as Federated States of Micronesia, Marshall Islands and Palau the crude death rates are similar at 5.3, 3.8 and 6.8 deaths per 1000 people, respectively.⁷

Morbidity and mortality data are important indicators which allow countries to plan for health resources, health systems, health policies and interventions. In Kiribati, the International Classification of Diseases (ICD)-10 is used to code morbidity and mortality data.⁸

Despite the adoption of ICD-10 codes in 1999, the Ministry of Health and Medical Services (MHMS) in Kiribati has identified that reporting on the causes of death could be improved. For example, there is no comprehensive cause of death data included in the World Health Organization (WHO) statistical profile for Kiribati.⁹ According to the ICD-10, the codes R00-R99 are used for ill-defined or unknown causes of death which have the general classification of “symptoms, signs and abnormal and laboratory findings, not elsewhere classified.”⁸ The percentage of ill-defined causes of death has been used as an indicator of the quality of coding and national vital registration systems, with a percentage of over 20% indicating low quality data.¹⁰ In Kiribati the number of ill-defined causes of deaths in 2011 was 16.6% of all deaths recorded, indicating that the quality of the data could be improved.⁶ These data suggest that health care staff may not be completing death certifications appropriately. In response to this problem, the MHMS organised training in death certification for Medical Officers in 2015. Further trainings for medical assistants are planned. It is anticipated that improved documentation of causes of death will improve mortality reporting overall and will allow the MHMS to better plan health services, programmes, and interventions.

To provide up to date and longitudinal information on ill-defined causes of death we undertook a study to describe causes of death over a ten year period (2005 to 2014) including the proportion of ill-defined causes of death in Kiribati, using national mortality data. Our ultimate aim is to strengthen cause of death reporting, ICD-10 coding and also to reduce the proportion of deaths that are recorded as ill-defined or unknown. Our data will provide a baseline against which future improvements can be measured. The study supports the fifth strategic objective of the Kiribati MHMS National Strategic Plan 2016-2019, ie, to “address gaps in health service delivery and strengthen the pillars of the health system.”¹¹

The specific objectives of our study were to report the total number of deaths per year recorded by hospitals and public health facilities from 2005 to 2014; to determine the number

and proportion of ill-defined causes of death stratified by gender, age group and type of health facility where the death was recorded and to report all ill-defined causes of death according to their ICD-10 code categories.

Methods

This was a retrospective descriptive study using national mortality data from the Health Information Unit, MHMS. The health system is primarily funded by the national Government with very little involvement of the private sector. It covers the 33 atolls (of which 21 islands are inhabited)³ and is further divided into six health districts. Healthcare is provided by government staff located in 4 hospitals, 34 health centres and 66 health dispensaries.⁶ Medical Officers are responsible for recording the cause of death for people who die in hospitals. In health centres and health dispensaries, Medical Assistants and Public Health Nurses are responsible for recording causes of death for both inpatients and outpatients.

The MHMS head office is located in South Tarawa (the capital island) and has a Health Information Unit which maintains a database of all deaths and causes of death. For deaths that occur in the main referral hospital on South Tarawa (Tungaru Central Hospital), Medical Coders collect information on the cause of death from the patient's medical record and enter this information into the Kiribati Health Information System, which is an online system available via the MHMS intranet. For all other deaths in the country, including those that occur at the other three hospitals, at health centres and health dispensaries, Medical Officers, Medical Assistants and Public Health Nurses report deaths and causes of deaths to the Health Information Unit on a monthly basis using a Monthly Statistics 1 (MS1) form. For people who die elsewhere (ie, at home or in the community) the death is reported on an MS-1 form as an outpatient death. The MS1 is a paper form that is posted or e-mailed to the Health Information Unit. Coding of deaths is then carried out by trained Medical Coders according to whatever is on the MS-1 form. This information is then entered into the MS1 system on the MHMS intranet. Therefore, information on mortality is available in two information systems, both of which are managed by trained staff at the Health Information Unit.

Our study population included all people whose deaths were registered in Kiribati between January 2005 and December 2014.

We extracted data from the Kiribati Health Information System and the MS1 System. Data variables extracted were: age group (under 1 year, 1-4 years, 5-14 years, 15-44 years, 45-54 years, 55-64 years, 65 years and above, and not recorded), gender, type of health facility in which the patient died (hospital, health centre, health dispensary), year of death, district of residence for the person who had died (Northern, Tarawa and Banaba, Central, North west, North east, Line and Phoenix), ICD-10 code and causes of death. For deaths which occurred at home, the nurse aid reported on the death to the public health nurse or medical assistant and these were recorded as outpatient deaths, from either health dispensary or health centre. The one who

assigned the cause of death was the public health nurse at the health dispensary or the medical assistant at health centre.

Data were analysed using Epi Info version 7 (Centers for Disease Control and Prevention, Atlanta, United States of America) and a descriptive analysis was performed. The number and proportion of all deaths for the years 2005 to 2014 were calculated, and the proportion of all deaths that were ill-defined was determined (ie, deaths in the R code family; the family that includes deaths that have symptoms, signs and abnormal laboratory or clinical findings not classified elsewhere). For all ill-defined deaths, numbers and proportions were calculated, stratified by year, gender, age group, and health facility in which the death was recorded. The ill-defined causes of death were then grouped according to ICD-10 categories (within the R code family) and we calculated numbers and proportions of ill-defined deaths per year.

Ethics Approval

Ethics approval was obtained from the Ethics Advisory Group of the International Union against Tuberculosis and Lung Disease, Paris, France. The Government of Kiribati does not have a human research ethics committee; however, the MHMS provided approval for the study.

Results

Between 2005 and 2014 there were 5618 deaths in Kiribati, ranging from 340 -788 deaths per year (Table 1; Figure 1). Of these, the majority of deaths occurred in the hospital setting (n=2588, 46.1%) while one fifth of deaths (n= 1170, 20.8%) occurred in a health centre and 33.1% (n=1860) in a health dispensary (Table 1). Table 1 provides information on the type of health facility in which patients died (or from where the death was reported), by year, for the years 2005-2014.

Table 1. Number and Pproportion of Total Deaths in Kiribati by Year (2005-2014) and Type of Health Facility in Which the Death was Recorded

| Year of Death | Death in Hospital N (%) | Death in Health Centre N (%) | Death in Health Dispensary N (%) | Total N |
|---------------|-------------------------|------------------------------|----------------------------------|---------|
| 2005 | 266 (44.0) | 132 (21.9) | 206 (34.1) | 599 |
| 2006 | 277 (45.0) | 139 (22.6) | 200 (32.5) | 616 |
| 2007 | 174 (37.7) | 112 (24.2) | 176 (38.1) | 462 |
| 2008 | 201 (39.6) | 112 (22.1) | 195 (38.4) | 508 |
| 2009 | 71 (20.9) | 102 (30.0) | 167 (49.1) | 340 |
| 2010 | 365 (61.9) | 85 (14.4) | 140 (23.7) | 590 |
| 2011 | 281 (57.2) | 72 (14.7) | 138 (28.1) | 491 |
| 2012 | 347 (44.0) | 178 (22.6) | 263 (33.4) | 788 |
| 2013 | 235 (44.2) | 104 (19.6) | 193 (32.4) | 532 |
| 2014 | 371 (54.0) | 134 (19.5) | 182 (26.5) | 687 |
| Total | 2588 (46.1) | 1170 (20.8) | 1860 (33.1) | 5618 |

Of the 5618 deaths, 1049 (18.7%) were classified as ill-defined. The number of ill-defined deaths ranged from 76 - 153 per annum, with a peak in 2012 (Table 2). Of the 1049 ill-defined deaths, 576 were male (54.9%) (Table 2; Figure 1). Those aged 65 years and above has the highest proportion of ill-defined deaths at 40% (n= 415), however in children aged 0-15 years almost 30% (29.6%, n=310) were ill-defined (Table 2). Almost half of all ill-defined deaths (47.7%, n=500) were reported by health dispensary staff (Table 2).

When the causes of ill-defined deaths were categorised according to their R code, the largest proportion of cases (30.5%, n=320) had an unknown cause of death, while 29.3% (n=307) had general symptoms and signs (Table 3). There was missing data for 5.4% (n=57) of ill-defined causes of death (Table 3).

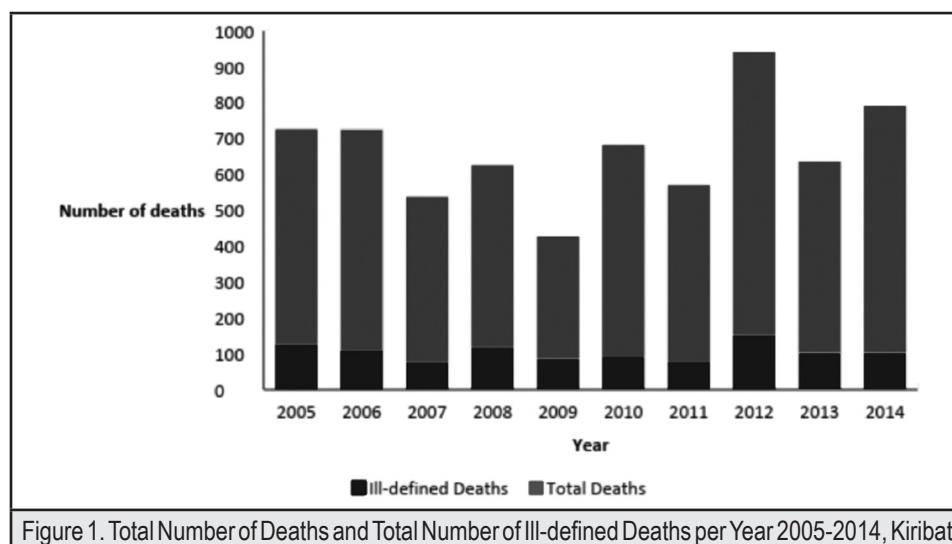


Figure 1. Total Number of Deaths and Total Number of Ill-defined Deaths per Year 2005-2014, Kiribati

| Characteristics | 2005 N (%) | 2006 n (%) | 2007 n (%) | 2008 n (%) | 2009 n (%) | 2010 n (%) | 2011 n (%) | 2012 n (%) | 2013 n (%) | 2014 n (%) | Total n (%) |
|--------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|
| Gender | | | | | | | | | | | |
| Male | 72 (56.7) | 52 (47.7) | 39 (51.3) | 59 (50) | 40 (6.9) | 47 (51.1) | 47 (59.5) | 98 (64.1) | 66 (63.5) | 56 (53.9) | 576 (54.9) |
| Female | 55 (43.3) | 57 (52.3) | 37 (48.7) | 58 (49.2) | 47 (10.0) | 43 (46.7) | 31 (39.2) | 54 (32.3) | 38 (36.5) | 48 (46.2) | 468 (44.6) |
| Not Recorded | 0 (0) | 0 (0) | 0 (0) | 1 (0.9) | 0 (0) | 2 (2.2) | 1 (1.3) | 1 (0.7) | 0 (0) | 0 (0) | 5 (0.1) |
| Age Group (Years) | | | | | | | | | | | |
| Under 1 | 14 (11.2) | 1 (0.9) | 0 (0) | 1 (0.9) | 2 (2.3) | 6 (6.5) | 7 (8.9) | 15 (9.8) | 8 (7.7) | 12 (11.5) | 66 (6.3) |
| 1-4 | 10 (7.9) | 5 (4.6) | 7 (9.2) | 3 (2.5) | 5 (5.8) | 2 (2.2) | 2 (2.5) | 8 (5.2) | 9 (8.7) | 1 (0.1) | 52 (5.0) |
| 5-14 | 2 (11.8) | 3 (2.8) | 0 (0) | 0 (0) | 3 (3.5) | 1 (1.1) | 1 (1.3) | 3 (2.0) | 1 (0.1) | 3 (2.9) | 192 (18.3) |
| 15-44 | 25 (19.7) | 26 (23.9) | 9 (11.8) | 23 (19.5) | 16 (18.4) | 15 (16.3) | 13 (16.5) | 29 (19.0) | 19 (18.3) | 17 (16.4) | 121 (11.5) |
| 45-54 | 13 (10.2) | 14 (12.8) | 10 (13.2) | 12 (10.2) | 13 (14.9) | 14 (15.2) | 5 (6.3) | 18 (11.8) | 10 (9.6) | 12 (11.5) | 17 (1.6) |
| 55-64 | 18 (14.2) | 11 (10.1) | 9 (11.8) | 11 (8.9) | 14 (16.1) | 9 (9.8) | 15 (19.0) | 17 (11.1) | 13 (12.5) | 7 (6.7) | 124 (11.8) |
| 65+ | 45 (35.4) | 40 (36.7) | 34 (44.7) | 46 (39.0) | 34 (39.1) | 39 (42.4) | 32 (40.5) | 58 (37.9) | 37 (35.6) | 50 (48.1) | 415 (40.0) |
| Not Recorded | 0 (0.0) | 9 (8.3) | 7 (9.2) | 22 (18.6) | 0 (0.0) | 6 (6.5) | 4 (5.1) | 5 (3.3) | 7 (6.7) | 2 (1.9) | 62 (6.0) |
| Type of Health Facility | | | | | | | | | | | |
| Hospital | 23 (18.1) | 25 (22.9) | 13 (17.1) | 21 (7.8) | 12 (3.8) | 38 (41.3) | 21 (26.6) | 52 (34.0) | 31 (29.8) | 21 (20.2) | 257 (24.5) |
| Health Centre | 37 (29.1) | 39 (35.8) | 20 (26.3) | 34 (28.8) | 26 (29.9) | 22 (23.9) | 16 (20.3) | 37 (24.2) | 26 (25.0) | 35 (33.7) | 292 (27.8) |
| Health Dispensary | 67 (52.8) | 45 (41.3) | 43 (56.6) | 63 (53.4) | 49 (56.3) | 32 (34.8) | 42 (53.2) | 64 (41.8) | 47 (45.2) | 48 (46.2) | 500 (47.7) |
| Total | 127 | 109 | 76 | 118 | 87 | 92 | 79 | 153 | 104 | 104 | 1049 |

| Year | Symptoms and Signs — Circulatory and Respiratory Systems R00-R09 n (%) | Symptoms and Signs — Digestive System and Abdomen R10-R19 n (%) | Symptoms and Signs — Skin and Subcutaneous Tissue R20-R23 n (%) | Symptoms and Signs — Genito-urinary System R30-R39 n (%) | Symptoms and Signs — Speech and Voice R47-R49 n (%) | General Symptoms and Signs R50-R69 n (%) | Abnormal Findings on Examination of Blood, Without Diagnosis R70-R79 n (%) | Abnormal Findings on Diagnostic Imaging and Function Studies, Without Diagnosis R90-R94 n (%) | Unknown Cause of Mortality R99 n (%) | Missing n | Total n |
|-------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------------|----------------|
| 2005 | 26 (20.5) | 25 (19.7) | 2 (1.6) | 1 (0.8) | 0 (0) | 41 (32.3) | 2 (1.6) | 0 (0) | 24 (18.9) | 6 (4.7) | 127 |
| 2006 | 8 (7.3) | 22 (20.2) | 2 (1.8) | 0 (0) | 0 (0) | 26 (23.9) | 2 (1.8) | 1 (0.9) | 37 (33.9) | 11 (10.1) | 109 |
| 2007 | 7 (9.2) | 13 (17.1) | 2 (2.6) | 0 (0) | 0 (0) | 23 (30.3) | 0 (0) | 0 (0) | 24 (31.6) | 7 (9.2) | 76 |
| 2008 | 20 (17.0) | 12 (10.2) | 4 (3.4) | 0 (0) | 0 (0) | 37 (31.4) | 1 (0.9) | 0 (0) | 39 (33.1) | 5 (4.2) | 118 |
| 2009 | 10 (11.5) | 15 (17.2) | 0 (0) | 0 (0) | 0 (0) | 25 (28.7) | 3 (3.5) | 0 (0) | 28 (32.2) | 6 (6.9) | 87 |
| 2010 | 18 (19.6) | 20 (21.7) | 0 (0) | 1 (1.1) | 1 (1.1) | 23 (25.0) | 2 (2.2) | 0 (0) | 19 (20.7) | 8 (8.7) | 92 |
| 2011 | 11 (13.9) | 9 (11.4) | 2 (2.5) | 0 (0) | 0 (0) | 26 (32.9) | 3 (3.8) | 0 (0) | 25 (31.7) | 3 (3.8) | 79 |
| 2012 | 23 (15.0) | 25 (16.3) | 4 (2.6) | 1 (0.7) | 2 (1.3) | 38 (24.8) | 3 (2.0) | 0 (0) | 49 (32.0) | 8 (5.2) | 153 |
| 2013 | 11 (10.6) | 17 (16.4) | 0 (0) | 0 (0) | 1 (0.1) | 29 (27.9) | 1 (0.1) | 0 (0) | 45 (43.3) | 0 (0) | 104 |
| 2014 | 13 (12.5) | 15 (14.4) | 1 (1) | 0 (0) | 0 (0) | 39 (37.5) | 3 (2.9) | 0 (0) | 30 (28.9) | 3 (2.9) | 104 |
| Total | 147 (14.0) | 173 (16.5) | 17 (1.6) | 3 (0.3) | 4 (0.4) | 307 (29.3) | 20 (1.9) | 1 (0.1) | 320 (30.5) | 57 (5.4) | 1049 |

Discussion

This is the first time that the Kiribati MHMS has examined completeness and consistency of the reporting of mortality data by staff from health facilities over a ten-year period. We showed that there are approximately 500 deaths per year in Kiribati and of these, almost one fifth of deaths (18.6%) are ill defined or unknown. This confirms our hypothesis that further efforts to improve death certification and reporting on cause of death are needed. We also showed that an ill-defined cause of death is more common among certain groups of people, including the elderly (aged 65 years and above), children (aged 0-14 years) and those whose death was reported by health dispensary staff. In addition, when ill-defined causes of death were further classified, approximately 60% had general signs and symptoms or an unknown cause of death.

The strength of this study was that it included national mortality data from the MHMS over a ten-year period. The information on where the death was recorded (ie, from which health facility) was fully completed. Another strength is that we reported our study according to STROBE and ReCORD guidelines.^{12,13} There were, however, some limitations. The main limitation was that we did not compare our data with the mortality data from the Kiribati Civil Registration Office (KCRO) system, which is managed by the Ministry of Internal Affairs. The MHMS systems for mortality reporting and the KCRO system are separate systems maintained by different Government Ministries. It may be of interest to compare the mortality data from the

two systems. Another limitation is that we attempted to verify some of the missing causes of death against medical records; however, these records were archived and were not available for our access. In addition we acknowledge that the proportion of ill-defined deaths may be higher than those found using the R codes alone as there are other unspecific ICD-10 codes that are not useful for public health planning and policy making.

Deaths reported by staff from health centres and dispensaries are recorded by Medical Assistants and Public Health Nurses who have not undergone Medical Certification of Causes of Death (MCCD) training. In 2015, Medical Officers took part in MCCD training, provided by staff from the World Health Organization (WHO). There are future plans to train and certify Medical Assistants using the same MCCD training. It is anticipated that training will further improve cause of death reporting and death certification. In addition to this, Kiribati will soon implement a system of carbon copy death certificates with three copies of a death certificate - one for the Ministry of Internal Affairs, one for the Health Information Unit, MHMS and one for the family of the deceased. Currently, death certificates are a single sheet of paper.

There are sparse data on the proportion of deaths that are ill defined in other Pacific Islands. However one study, conducted in 2005 estimated the proportion of all deaths that were ill-defined for 115 countries; 12 were Pacific Islands.⁸ Of these, five (42%) had complete data.¹⁰ In these countries, the proportion of all deaths that were ill-defined ranged from 0% in Niue

to 35% in Kiribati.¹⁰ Other countries with a high proportion of ill-defined deaths were Fiji (29%) and Tuvalu (27%).¹⁰ While that study is not directly comparable to ours, the proportion of ill-defined deaths in our study is lower than that reported in the 2005 paper.¹⁰ This paper also classified countries into data quality groups (ie, high, medium and low) based on three main criteria: a) type of cause of death coding used, b) completeness of cause of death data, and c) the proportion of deaths that were ill defined.¹⁰ Using this classification, Kiribati was classified as having medium data quality.¹⁰

We reported that a large proportion of deaths are ill-defined in Kiribati and therefore reporting on the cause of death needs to be improved. While training of Medical Officers on death certification has begun, Medical Assistants are yet to be trained and there may be a need to train Public Health Nurses as well. In addition, it may be useful to provide feedback to health professional on the completeness of mortality data including new policies regarding death certification.

Conclusion

Almost one fifth of all deaths in Kiribati were ill-defined and this could be improved by the introduction of MCCD training to all the health personnel who are responsible for certifying deaths. Improved quality of mortality data should allow the MHMS to better target health services, programs and interventions.

This study has some applications that can be recommended and implemented in the Kiribati context. It is recommended to provide training on death certification to all classes of health care professionals who might certify deaths. In addition continuous feedback to health care professionals on the completeness of mortality data is needed. This can be done by distributing annual health bulletins from the Health Information Unit to all the health centers and hospitals including Head of Departments and Directors in the main Hospital.

Conflict of Interest

None of the authors identify a conflict of interest.

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References

1. Kiribati National Statistics Office. 2015 Population and Housing Census Preliminary Report. Tarawa, Kiribati: National Statistics Office. <http://www.mfed.gov.ki/sites/default/files/Revised%20Census%20Preliminary%20Report%202%20020516%20update%20%5B1306646%5D.pdf>. Accessed February 13, 2017.
2. The World Bank. Kiribati. Washington DC, United States of America: The World Bank. <http://data.worldbank.org/country/kiribati>. Accessed February 13, 2017.
3. Government of Kiribati, About Kiribati. Tarawa, Kiribati: Government of Kiribati. <http://www.president.gov.ki/about-kiribati/>. Accessed February 13, 2017.
4. Commonwealth Health Online. *Non-communicable diseases in Kiribati*, Cambridge, United Kingdom: Commonwealth Health Online. http://www.commonwealthhealth.org/pacific/kiribati/non_communicable_diseases_in_kiribati/. Accessed February 13, 2017.
5. McIver L, Kim R, Woodward A, et al. Impacts of climate change in Pacific Island countries: A regional assessment of vulnerabilities and adaptation priorities. *Environmental Health Perspectives*. 2016;124(11):1707-1714.
6. Ministry of Health and Medical Services. Kiribati Annual Report 2011. Tarawa, Kiribati: Kiribati Ministry of Health and Medical Services. 2011.
7. The Pacific Community. 2018 Pocket statistical summary. Noumea, New Caledonia: The Pacific Community. <https://prism.spc.int/> Accessed September 4 2018.
8. World Health Organization. ICD-10: Version 2016. Geneva, Switzerland: World Health Organization. <http://apps.who.int/classifications/icd10/browse/2016/en>. Accessed 13 February 2017.
9. World Health Organization. Kiribati: WHO statistical profile. Geneva, Switzerland: *World Health Organization*. <http://www.who.int/gho/countries/kir.pdf?ua=1> Accessed September 4 2018.
10. Mathers CD, Ma Fat D, Inoue M, Rao C, Lopez AD. *Counting the death and what they died from: an assessment of the global status of cause of death data*. Bulletin of the World Health Organization, 2005; 83(3): 171-177.
11. Ministry of Health and Medical Services. *Ministry Strategic Plan 2016-2019*. Tarawa, Kiribati: Kiribati Ministry of Health and Medical Services. 2015.
12. Benchimol EI, Smeeth L, Guttman A, et al. The Reporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLoS Medicine*. 2015;12(10):e1001885. doi:10.1371/journal.pmed.1001885.
13. Von Elm V, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. *Strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies*. *British Medical Journal*. 2007; 335 doi: <https://doi.org/10.1136/bmj.39335.541782.AD>.